Lake Havasu Drag Strip
Noise Technical Report

June 2012

Prepared for

Lake Havasu City
2330 McCulloch Blvd North
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Acronyms

BMPs	Best Management Practices
CFR	Code of Federal Regulations
City	City of Lake Havasu
dB	Decibels
dBA	Units of Decibels
DOT	Department of Transportation
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
Ldn	Day-Night Average Noise Level
Leq	Equivalent Energy Level
Lmax	Maximum Noise Level
NHRA	National Hot Rod Association
PA	Public Address System
SEL	Sound Exposure Level
SR 95	State Route
VdB	Vibration Decibels

1.0 Executive Summary

This report assesses potential noise and vibration impacts associated with the implementation of the Lake Havasu City Drag Strip Project, herein referred to as the project. The project will be a venue for drag strip racing events, and the site plan includes a parking area for spectators, pit area for participants, grand stands and drag strip, located entirely within the City of Lake Havasu, Arizona, in the northeastern area of the city. The City of Lake Havasu (City) is located in Mojave County. This report is intended to inform the City of potential noise or vibration impacts associated with operation of the project, access the compatibility of the project relative to land uses in the area, and propose noise-attenuation measures where feasible to address adverse noise impacts.

1.1 Findings

Operation of the proposed project would result in excessive maximum noise levels related to professional dragsters (e.g., Top Fuel, Super Stock, Pro Stock, Federal Mogul Funny Car). Implementation of recommended attenuation measures such as, solid back grandstands, and incorporating a berm/wall to shield finish line noise would reduce excessive maximum noise levels due to professional dragster events, but maximum noise levels would still have the potential to exceed the City's noise ordinance. Professional drag racing events are expected to occur approximately twice per year.

During the spring and fall seasons, street legal and hobbyist dragster racing events would not result in excessive noise levels that exceed the City's noise ordinance. Other operational components of the project (pit area noise, parking lot noise and public address [PA] system noise) are anticipated to comply with allowable noise levels established by the City's noise ordinance. Construction of the proposed project would result in short-term noise increases that may affect surrounding uses; however, compliance with the daytime operating limits included in the City's noise ordinance and implementation of best management practices would reduce excessive construction noise levels to the extent feasible. Buildout of the proposed project would result in traffic noise increases along State Route (SR 95) and the relocation of Whelan Drive within the project site; however, these short-term increases in traffic noise during days when events occur would not be considered substantial. There would be no substantial adverse long-term traffic noise increases associated with implementation of the project.

2.0 Introduction

2.1 Purpose

The objectives of this noise study are to:

1. Describe the existing noise environment and regulatory requirements.
2. Provide an assessment of the potential noise impacts that would result from implementation of the project related to construction, traffic, and operational noise sources.

3. Compare the changes in estimated noise levels due to the implementation of the project to applicable noise regulations and standards.
4. Provide measures where necessary to avoid or reduce noise impacts to the degree feasible in order to meet applicable noise regulations and standards.

2.2 Project Description

Figure 1, Regional Location, and Figure 2, Project Area, illustrate the project's location and surrounding uses. The project site shown on Figure 2 is 148 acres in area, and the City of Lake Havasu City proposes to grade the site using motor graders in preparation of site development. Site development would include construction of a drag strip race track and ancillary facilities, including stand seating, pit area, parking, a PA system for announcements and roadway relocation. The project site is located in the northern area of Section 15, Township 14 North, Range 20 West, Latitude ˚N 34 33 22.861, Longitude ˚W 114 20 39.846. The area is surrounded by the Lake Havasu City Airport and open desert to the north, Havasu RV Resort and open desert to the south, the Lake Havasu City Wastewater Treatment Plant, open desert and aggregate uses to the east, and planned industrial land uses and open desert to the west. SR 95 is located 0.5 mile to the west of the project site (Figure 1).

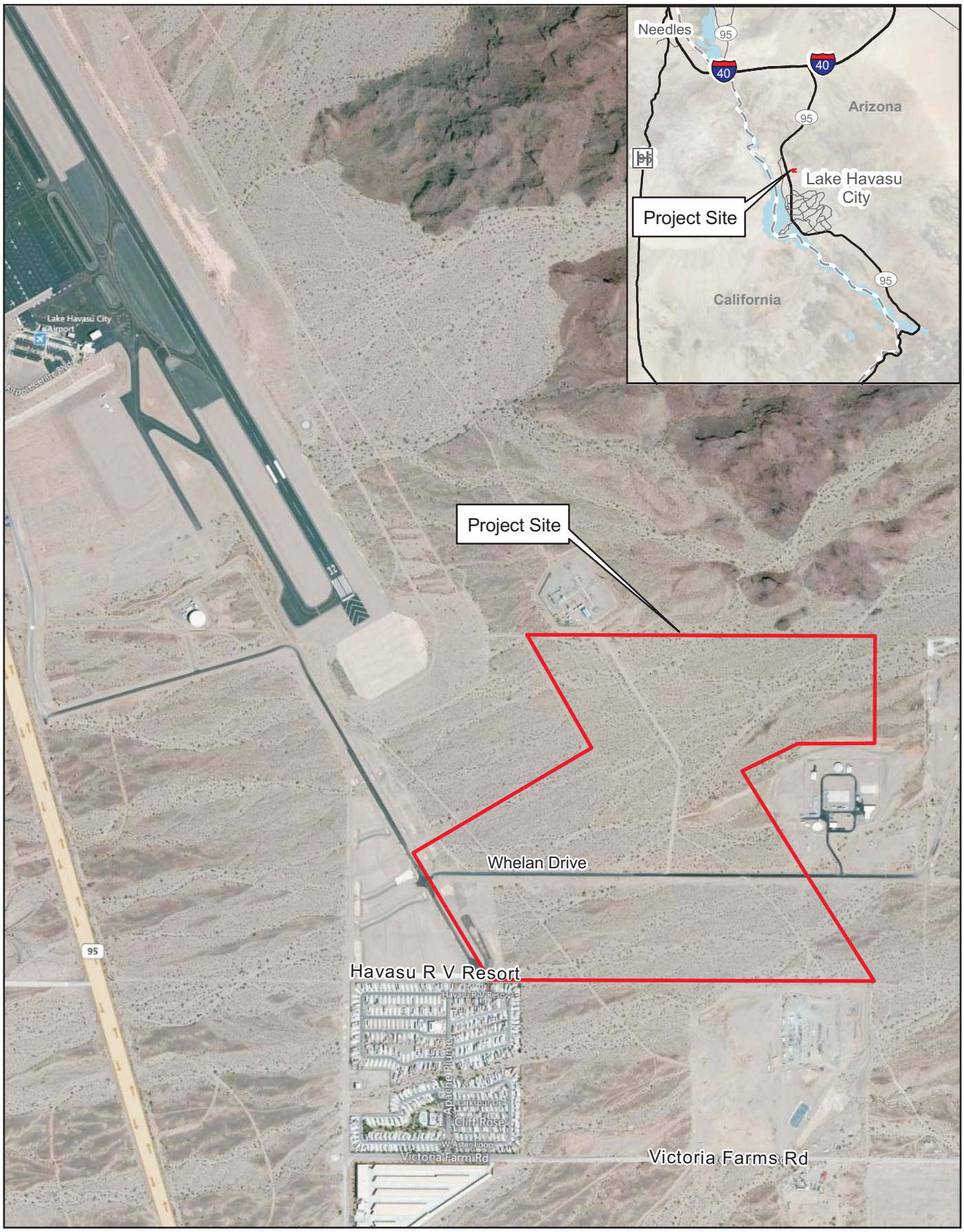
Drag race events are anticipated to occur once a week and operate for 2 to 3 hours. The primary users of the drag strip would be hobbyists or street legal racers. There may be one or two events per year that consist of professional non-muffled racers. It is anticipated that there could be up to 300 racers participating at each event. The preliminary scheduling for drag races would be during the evening time in the fall and spring. Access to the project site is provided by Whelan Drive, which currently bisects the project site. The project proposes to relocate Whelan Drive to the southern boundary of the project site adjacent to the existing Havasu RV Resort; the existing roadway is approximately 800 feet to the north of Havasu RV Resort. Figure 2 shows the features associated with project to the open space north of the Havasu RV Resort.

3.0 Environmental Setting

3.1 Noise Basics

3.1.1 Quantification of Noise

Noise is commonly defined as unwanted sound. Sound pressure magnitude is measured and quantified using a logarithmic ratio of pressures, the scale of which gives the level of sound in decibels (dB). Sound pressures in the environment have a wide range of values and the sound pressure level was developed as a convenience in describing this range as a logarithm of the sound pressure. The sound pressure level is the logarithm of the ratio of the unknown sound pressure to a reference quantity of the same kind. To account for the pitch of sounds and the corresponding sensitivity of human hearing to them, the raw sound pressure level is adjusted with an A-weighting scheme based on frequency that is stated in units of decibels (dBA). Typical A-weighted noise levels are listed in Table 1.



Source: ESRI 2012

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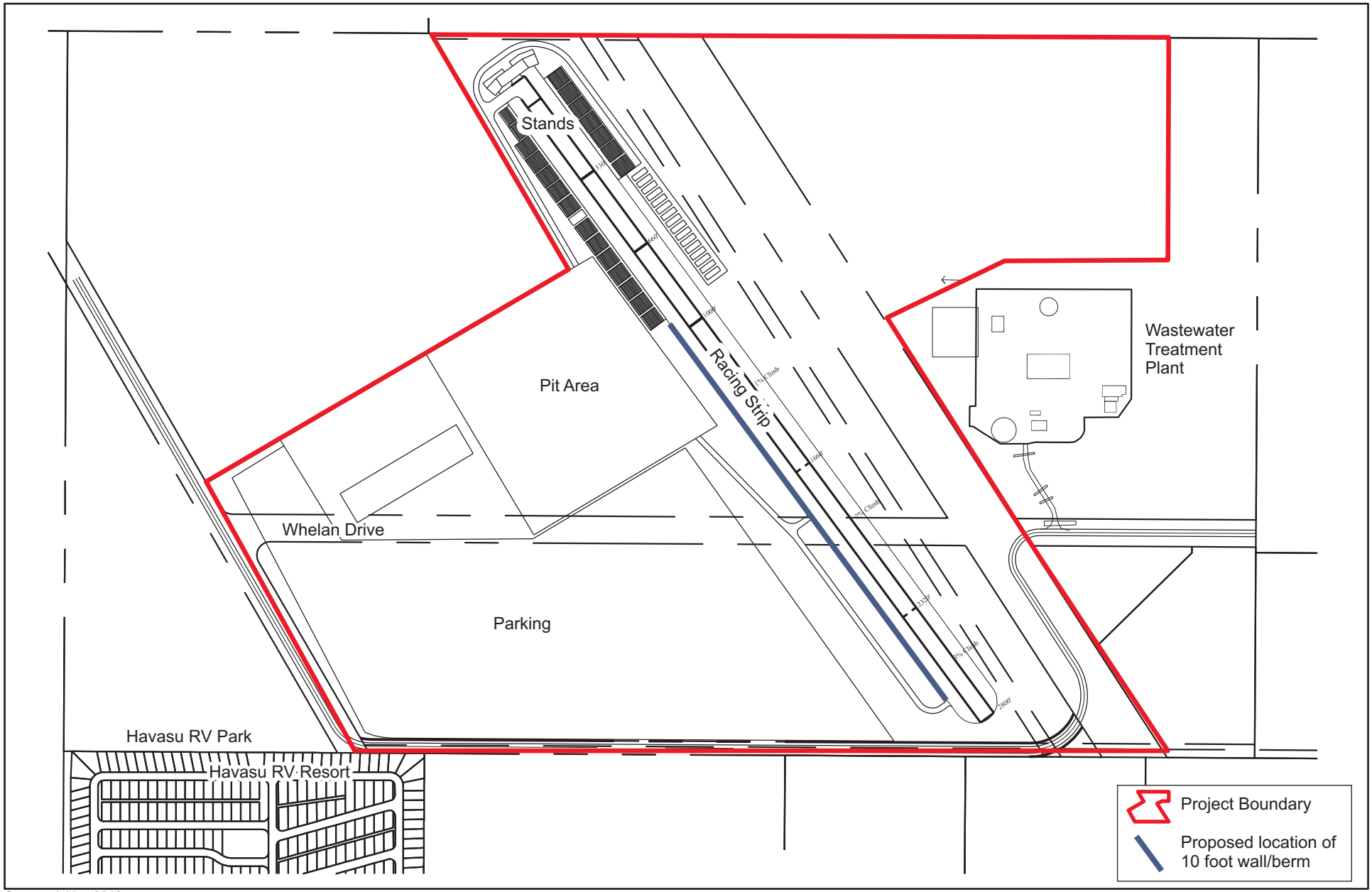
REGIONAL LOCATION
FIGURE 1



Source: Atkins 2012

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PROJECT AREA
FIGURE 2

Table 1 Typical A-Weighted Noise Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet fly-over at 1,000 feet		
	— 100 —	
Gas lawn mower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	— 80 —	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	**— 70 —**	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	**— 60 —**	
		Large business office
Quiet urban daytime	**— 50 —**	Dishwasher next room
Quiet urban nighttime	**— 40 —**	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night, concert
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	**— 0 —**	Lowest threshold of human hearing

Source: Caltrans 1998.

A given level of noise may be more or less tolerable depending on the sound level, duration of exposure, character of the noise sources, the time of day during which the noise is experienced, and the activity affected by the noise. For example, noise that occurs at night tends to be more disturbing than that which occurs during the day because sleep may be disturbed. Additionally, rest at night is a critical requirement in the recovery from exposure to high noise levels during the day. In consideration of these factors, different measures of noise exposure have been developed to quantify the extent of the effects anticipated from these activities. For example, some indices consider the 24-hour noise environment of a location by using a weighted average to estimate its habitability on a long term basis. Other measures consider portions of the day and evaluate the nearby activities affected by it as well as the noise sources. The most commonly used indices for measuring community noise levels are the Equivalent Energy Level (Leq) and the Day-Night Average Noise Level (Ldn).

> ***Leq***, the Equivalent Energy Level, is the average acoustical or sound energy content of noise, measured during a prescribed period, such as 1 minute, 15 minutes, 1 hour, or 8 hours. It is the decibel sound level that contains an equal amount of energy as a fluctuating sound level over a given period of time.

***Ldn*,** Day-Night Average Noise Level, the day-night average noise level, is a 24-hour average L_{eq} with a 10 dBA "penalty" added to noise during the hours of 10:00 p.m. to 7:00 a.m. to account for increased nighttime noise sensitivity. Because of this penalty, the L_{dn} is always higher than its corresponding 24-hour L_{eq} (e.g., a constant 60 dBA noise over 24 hours would have a 60 dBA L_{eq}, but a 66.4 dBA L_{dn}).

The decibel level of a sound decreases (or attenuates) exponentially as the distance from the source of that sound increases. For a single point source such as a piece of mechanical equipment, the sound level normally decreases by about 6 dBA for each doubling of distance from the source. Sound that originates from a continuous linear, or "line" source such as a heavily traveled traffic corridor, attenuates by approximately 3 dBA per doubling of distance, provided that the surrounding site conditions lack ground effects or obstacles that either scatter or reflect noise. Noise from roadways in environments with major ground effects due to vegetation and loose soils may either absorb or scatter the sound yielding attenuation rates as high as 4.5 dBA for each doubling of distance. Other contributing factors that affect sound reception include meteorological conditions and the presence of manmade obstacles such as buildings and sound barriers.

3.1.2 Noise Effects

Noise has a significant effect on the quality of life. An individual's reaction to a particular noise depends on many factors such as the source of the noise, its loudness relative to the background noise level, and the time of day. The reaction to noise can also be highly subjective; the perceived effect of a particular noise can vary widely among individuals in a community. Because of the nature of the human ear, a sound must be about 10 dBA greater than the reference sound to be judged as twice as loud. In general, a 5 dBA change in community noise levels is clearly noticeable, and a 3 dBA change is the smallest increment that is perceivable by most receivers. Generally, 1 to 2 dBA changes generally are not detectable. Although the reaction to noise may vary, it is clear that noise is a significant component of the environment, and excessively noisy conditions can affect an individual's health and well-being. The effects of noise are often only transitory, but adverse effects can be cumulative with prolonged or repeated exposure. The effects of noise on a community can be organized into six broad categories: sleep disturbance, permanent hearing loss, human performance and behavior, social interaction of communication, extra-auditory health effects, and general annoyance.

3.2 Environmental Vibration Basics

3.2.1 Quantification of Groundborne Vibration

Vibration is defined as any oscillatory motion induced in a structure or mechanical device as a direct result of some type of input excitation. Vibration consists of waves transmitted through solid material. The solid medium can be excited by forces, moments, or pressure fields. This leads to the terminology of "structure-borne/ground-borne" vibration. Vibration energy spreads out as it travels through the ground, causing the vibration amplitude to decrease with distance away from the source.

The ground motion caused by vibration is given in decibel notation, referenced as vibration decibels (VdB), which serves to compress the range of numbers required to describe vibration relative to human response. Ground-borne vibration levels of 65 VdB can result in ground-borne noise levels up to 40 dBA,

which can disturb sleep. Ground-borne vibration levels of 85 VdB can result in ground-borne noise levels up to 60 dBA, which can be annoying to daytime noise sensitive land uses such as schools.

The vibration velocity level threshold of perception for humans is approximately 65 VdB. A vibration velocity level of 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels for many people. Most perceptible indoor vibration is caused by sources within buildings, such as the operation of mechanical equipment, movement of people, or the slamming of doors. Typical outdoor sources of perceptible ground-borne vibration are heavy construction equipment, steel-wheeled trains, and traffic on rough roads. The range of interest is from approximately 50 VdB, which is the typical background vibration velocity level, to 100 VdB, which is the general threshold where minor damage can occur in fragile buildings.

3.2.2 Vibration Effects

Groundborne vibration can disrupt vibration sensitive land uses by causing movement of buildings, rattling of windows and items inside buildings, rumbling sounds, and even property damage. Vibration sensitive land uses include residential uses or those uses where operations or equipment, such as research, manufacturing, hospitals, and university research operations (FTA 2006) are considered "vibration-sensitive." The degree of sensitivity depends on the specific land use or the equipment that would be affected by the groundborne vibration. Excessive levels of groundborne vibration of either a regular or an intermittent nature can result in annoyance to surrounding uses.

3.3 Regulatory Framework

3.3.1 National Hot Rod Association

National Hot Rod Association (NHRA) 2012 Rulebook

The NHRA does not specify acceptable noise levels associated with the operation of individual tracks; however, it is part of the NHRA's intent to be sensitive to adjacent land uses to a track and observe the environments of noise sensitive land uses in close proximity to tracks.

Section 7 of the NHRA 2012 Rulebook states:

> When competing at national and divisional events, vehicle may not exceed 95 decibels as measured on the "A" scale from a distance of 50 feet, at a right angle to the vehicle, with the vehicle at a no-load rpm of 3,500. Sound suppression device not mandatory if vehicle passes testing.

Section 20 of the NHRA 2012 Rulebook states:

> Part of NHRA's mission is to preserve the right to race. In many communities, the right to race is contingent upon reducing noise and complying with local noise and muffler laws, ordinances, regulations or agreements. Therefore, all competitors must comply with any muffler rules applicable to his or her class in the Rulebook, and must comply with any noise-reduction requirements (including mufflers) mandated by an member track at which her or she races. Member tracks have the authority to impose muffler rules and regulations beyond those required by the NHRA Rulebook.

3.3.2 Local

Lake Havasu City General Plan 2002

The Lake Havasu City General Plan identifies noise as a concern when developing land uses and compatibility between new and existing land uses. The General Plan has not established specific numerical thresholds in decibels, but does identify noise as a component of growth management issues. As part of the Growth Management Goals and Polices listed within the General Plan a specific goal relating noise and planning has been identified. The City's main goal is to minimize the impact of noise within the planning area and to ensure that compatible land uses are planned relative to adjacent uses with consideration given to mitigation strategies that are compatible with the area's character.

Lake Havasu City, Arizona Code of Ordinances

Specific noise thresholds are listed in the Lake Havasu City, Arizona Code of Ordinances. Chapter 9.30: Noise, defines Noise Zones and establishes allowable noise levels within each Noise Zone. Table 2 shows the allowable noise level for each noise zone. The Noise Zone for a property is based on its zoning district designation.

Table 2 City of Lake Havasu Allowable Exterior Noise Level Limits

Noise Zone	Time Interval	Allowable Noise Level
Sunday - Thursday (Week Days)		
I	10:00 p.m. to 7:00 a.m. 7:00 a.m. to 10:00 p.m.	45 dB(A) 65 dB(A)
II	10:00 p.m. to 7:00 a.m. 7:00 a.m. to 10:00 p.m.	60 dB(A) 70 dB(A)
Friday -Saturday (Weekends) and Holidays		
I	12:00 a.m. to 7:00 a.m. 7:00 a.m. to 12:00 a.m.	45 dB(A) 65 dB(A)
II	12:00 a.m. to 7:00 a.m. 7:00 a.m. to 12:00 a.m.	60 dB(A) 70 dB(A)
Sunday-Saturday (All Week)		
III	10:00 p.m. to 7:00 a.m. 7:00 a.m. to 10:00 p.m.	60 dB(A) 85 dB(A)

Notes: Noise Zone I: All single, double and multiple-family residential structures or property.
Noise Zone II: All commercial and mixed use properties.
Noise Zone III: All manufacturing or industrial properties.
Source: Lake Havasu Noise Ordinance §9.30.050

The noise level limits prohibit activities that cause the noise level on any property to exceed the allowable noise levels listed in Table 2 as a measured average over any 5 minute period of measurement, or the noise standard plus 10 dB(A) at any time. If the measurement location is on a boundary between two zoning districts, the lower noise standard shall apply.

The noise ordinance specifies limits for construction work, which is restricted to the hours between 7:00 a.m. and 7:00 p.m. Concrete pouring is restricted to the hours between 6:00 a.m. and 7:00 p.m. on any Saturday, Sunday or holiday, unless such other times are authorized by permit.

The City's noise standards do not include a noise descriptor with the numerical threshold. For the purposes of this analysis, it is assumed that the allowable noise levels listed per Noise Zone are average day/night noise levels for mobile sources, typically accompanied with an Ldn noise descriptor, and equivalent energy noise level for stationary or operational source, typically accompanied with a Leq noise descriptor. Under section 9.30.050, Subsection E of the Code, it is assumed that an allowable instantaneous maximum noise level (Lmax) of 10 dBA over the Noise Zone day/night noise level is considered acceptable. For instance, an allowable noise level for Noise Zone III is 85 dBA during the hours of 7:00 a.m. to 10:00 p.m. would mean that an instantaneous maximum noise level of 95 dBA Lmax would be considered acceptable for those land uses (industrial) within Noise Zone III.

Figure 3 shows the City's zoning districts for the project area. The project site includes zoning district A-1 (Light Agricultural), M-2 (Heavy Manufacturing), P-1 (Public Lands and Facilities), and M-1-P (Industrial Park). The project site is within Noise Zone III.

The adjacent property to the south includes the Havasu RV Resort, which is located approximately 200 feet west of the southwestern corner of the project parking lot. The Havasu RV Resort property was originally zoned as Light Agricultural/Planned Development (A-1/PD); however, the applicant for the Havasu RV Resort was granted an amendment to the General Development Plan for rezoning the property to Industrial Park/Planned Development (M-1P/PD) on May 25, 1999 (Usinowicz, 2002). The City of Lake Havasu considers the Havasu RV Resort as a transient use under its conditional use permit. Therefore, based on its zoning district designation, the Havasu RV Resort property is within Noise Zone III.

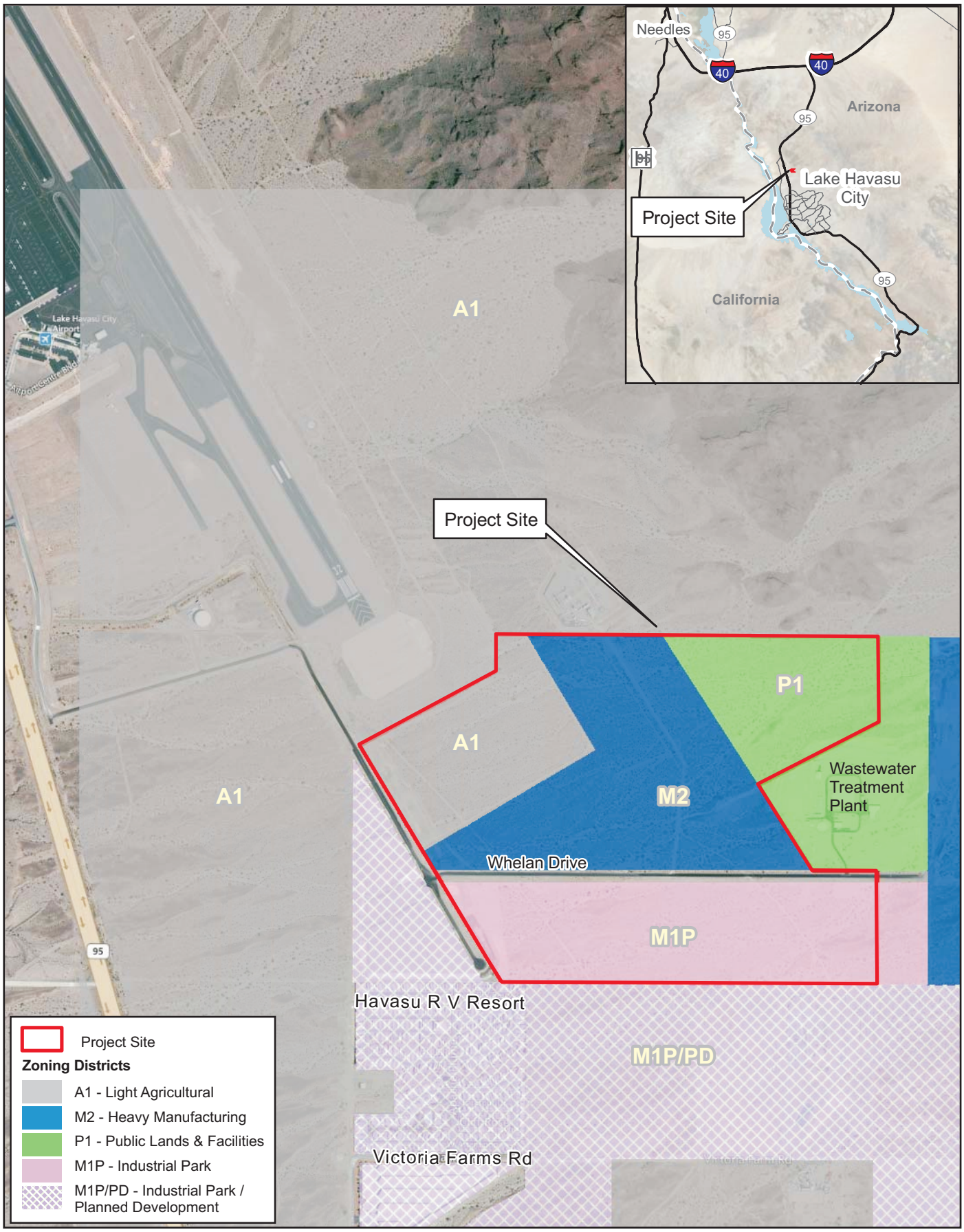
The properties to the west and north are zoned A-1 (Light Agricultural), and the wastewater treatment plant to the east is zoned P-1 (Public Lands and Facilities). Based on the zoning district designations, these surrounding uses are also within Noise Zone III.

3.4 Existing Noise Environment

Existing noise sources, including transportation, operation, and construction that affect the project site are described below.

3.4.1 Existing Noise Levels

An ambient noise level survey was conducted on May 1 through May 2, 2012, to quantify the noise environment at the nearest noise sensitive land use adjacent to the project. A total of four measurement sites were chosen in the existing RV neighborhood south of the project site. The measurements were taken during the daytime (9:00 a.m. to 2:00 p.m.) and were 15 minutes in duration. A Larson Davis 820 ANSI (American National Standards Institute) Type I Integrating Sound Level Meter calibrated with a Larson Davis CAL200 calibrator was used to measure ambient noise levels. Weather conditions during the measurements were slightly windy with a mild to hot temperatures and partly-cloudy to clear skies. Table 3 summarizes the measured Leq and noise sources for each monitoring location, and the on-site monitoring locations are shown on Figure 4.



Source: ESRI 2012; City of Lake Havasu 2012

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Feet

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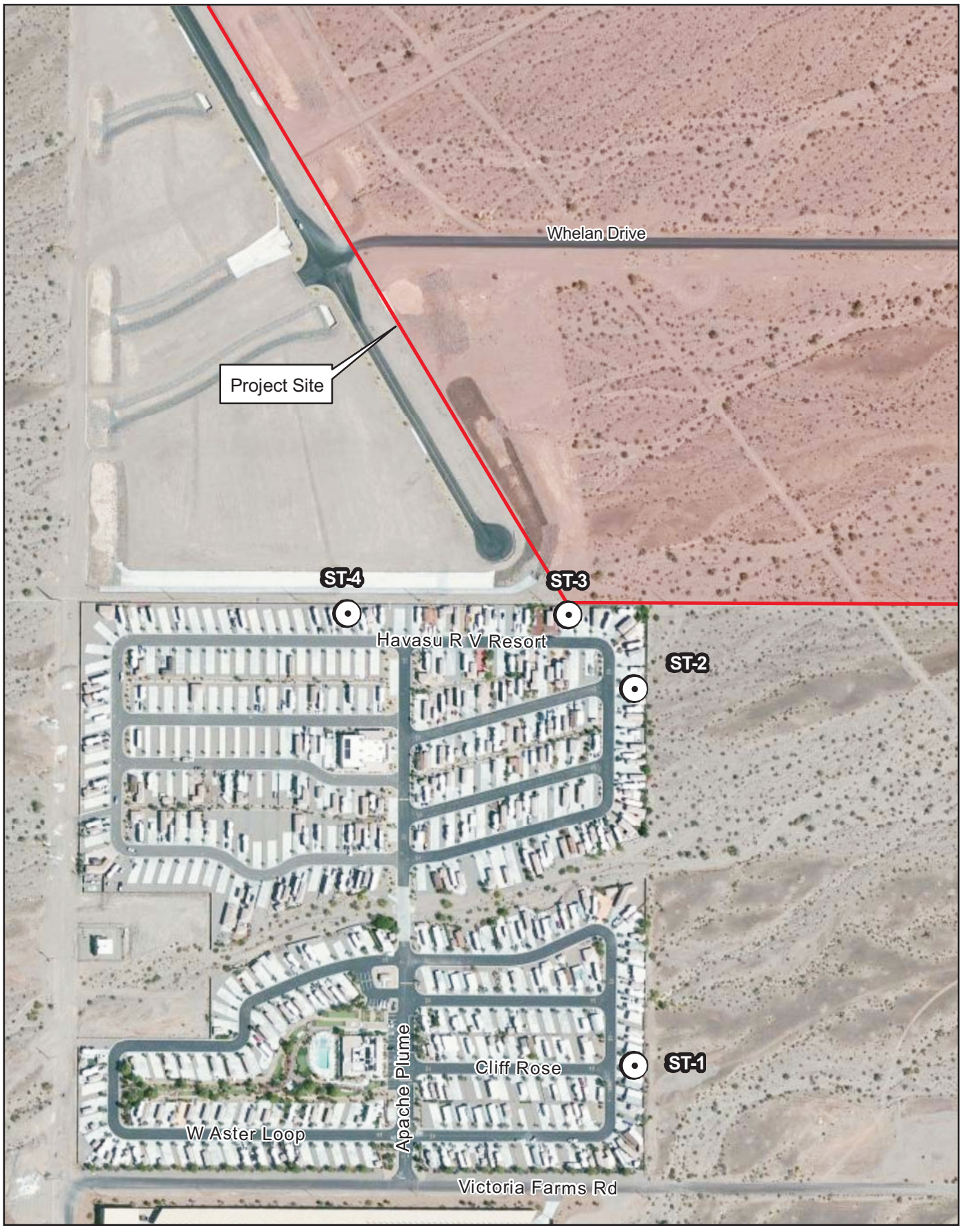
CITY OF LAKE HAVASU ZONING DISTRICT
FIGURE 3



Source: Bing 2012

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Feet

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SHORT TERM NOISE MEASUREMENTS
FIGURE 4

Table 3 Ambient Noise Level Measurements (dBA)

Site	Location	Daytime Noise Sources	Date	Time	Leq	Lmax [a]	Lmin
1	Lot 89 – southeastern boundary area of Havasu RV Resort	Residential activities, HVAC, aircraft over-flights, birds, distant scrap yard activities	5-1-12	12:22 p.m.	49	64	37
			5-2-12	9:08 a.m.	48	66	35
2	Lot 193 – northeastern boundary area of Havasu RV Resort	Residential activities, aircraft over-flights, birds, distant off road vehicle activities	5-1-12	12:43 p.m.	46	62	35
			5-2-12	9:28 a.m.	77	102[b]	33
3	Lot 200 – northern boundary area of Havasu RV Resort	Residential activities, aircraft over-flights, birds, distant waste water treatment plant activities	5-1-12	1:00 p.m.	50	68	39
			5-2-12	9:49 a.m.	47	63	38
4	Lot 315 – northwestern boundary area of Havasu RV Resort	Residential activities, aircraft over-flights, birds, distant traffic	5-1-12	1:22 p.m.	55	77	42
			5-2-12	10:07 a.m.	50	66	43

Source: Atkins, 2012. Ambient measurements were 15 minutes in duration.

[a] Lmax noise levels were attributable to single propeller aircraft over-flights unless noted otherwise

[b] Jet over-flight

The results of the ambient noise survey reflect noise levels that range between 42 dBA and 55 dBA Leq adjacent to the project site. The short term measurement at Site 2 did measure higher than typical noise levels and this was due to the one jet over-flight. The primary noise sources included neighborhood activities and single-propeller over-flights attributable to Lake Havasu Municipal Airport. Although SR-95 is the closest major roadway to the project site, traffic noise was not measurable at the Havasu RV Resort. Havasu RV Resort residential vehicle pass-bys (trucks, golf carts, utility vehicles) also contributed to the noise environment. At the time of the ambient noise level measurements the Havasu RV Resort was approximately 15 to 20 percent occupied because most of the residents had already left for the summer. It is assumed that during the winter months the RV resort would be at or near capacity and ambient noise levels within the neighborhood would range between 55 dBA and 60 dBA, due to more vehicular, HVAC, maintenance, and general residential activity.

3.4.2 Transportation Noise Sources

Aviation

The nearest airport to the project site is Lake Havasu Municipal Airport, located adjacent to, and north of the site. The airport is a general aviation airport. It accommodates propeller and jet powered aircraft. The airport has an 8,000 foot long runway. The predominant runway alignments are north-south. Because the airport primarily serves fixed single propeller aircraft types, the noise contours do not extend substantially from the runway and the project area is not located within 65 dBA Ldn noise contour for the airport (Coffman Associates 2009). As shown in Table 3, typical single propeller aircraft over-flight events measured between 62 dBA and 68 dBA Lmax, however, one jet over-flight measured 102 dBA Lmax during short term ambient noise measurements.

Roadways

Only one paved roadway currently bisects the project site and serves the waste water treatment plant and the aggregate use further to the east. A few dirt roads are located on the project site for occasional vehicle trips for maintenance of the existing power lines. Vehicular traffic along this roadway does not have much of a contribution to the overall noise environment on the project site. The major roadway in the area and west of the project site is SR-95, located approximately 0.5 mile west of the project site. Existing noise levels attributable to SR-95 range between 63 dBA and 68 dBA Ldn at 100 feet from the roadway, as shown in Table 6.

3.5 Impact Analysis

Potential project-related noise impacts from construction activity, transportation sources, and operational sources are discussed below. The implementation of the Lake Havasu City Drag Strip Project would have the potential to generate noise levels in excess of established standards by developing new sources of noise associated with track operation, by increasing vehicular traffic to the project site, and by construction activities associated with track, ancillary facilities, and roadway relocation construction.

3.5.1 Operational Noise

Drag Strip Event Noise

The proposed drag strip would be approximately 2,800 feet long and is shown in Figure 2. Grandstands would be located on both sides of the drag strip beginning at the starting line and extending for approximately 1,000 feet down the track on the western side of the strip and approximately 500 feet down the track on the eastern side of the strip. The drag strip would be used once a week, typically on weekends, for events that would entail 2 to 3 hours of racing. The number of participants estimated to take part in racing events is approximately 300 racers and events would take place on evenings during the fall and spring months. A typical drag race includes two dragsters racing side by side for approximately 6 to 14 seconds for a quarter mile down the track. Provided that 300 cars are anticipated to race for up to 3 hours, there would be 50 races per hour. The majority of events would be for street legal racers, but there could be one or two events a year of non-muffled professional racers. The PA system would announce race events, results and other announcements to the spectators.

Conducting representational measurements of drag strip noise levels was not possible at the time of this analysis. Reference noise levels of previously measured drag strip races are shown in Table 4. Table 4 shows the results of noise measurements for several classes of drag racers. Measurements were conducted at 50 feet from the near lane centerline, 50 feet from down the track from the starting line. The majority of project events would only include street legal dragsters shown in the first row of Table 4. Additional reference noise level data is included to encompass the one to two professional drag racing events anticipated to occur at the project site. The Lmax noise levels would be generated for approximately 14 seconds for street legal dragsters and for approximately 6 seconds for professional dragsters per race. There would be a period of several seconds of Lmax noise levels generated by dragsters before the start of each race to warm up the tires during burnouts at the starting line.

Professional Class. As shown in Table 4, professional class Top Fuel dragsters measured the highest noise levels ranging from 98 dBA to 137 dBA Lmax at 50 feet from the centerline of the near lane. One or two events a year would be anticipated to generate these high noise levels. These noise levels would

attenuate at a rate of 6 dBA per doubling of distance. The starting line for the drag strip would be approximately 2,400 feet from the southern property line and the finish line would be approximately 1,900 feet from the property line. Typical noise levels attributable to top fuel dragsters would range from 64 dBA to 105 dBA Lmax at the property line and would be clearly audible at the Havasu RV Resort.

Applying the typical noise level range of 112 dBA to 126 dBA Lmax at 50 feet for Top Fuel dragsters and assuming that there are two cars per drag race, drag races would be conducted in 3 hours consisting of 300 participants resulting in 50 races per hour, hourly noise levels attributed to street legal drag races would range between 83 dBA to 97 dBA Leq at 50 feet. The highest hourly noise level at the southern property line would be 66 dBA Leq. Therefore, professional class Top Fuel dragsters would not exceed the City's hourly noise ordinance of 85 dBA at the southern property line.

Table 4 Summary of Drag Strip Racing Event Maximum Noise Levels (Lmax)

Class	Average(dBA)	Range (dBA)
Street Legal Dragsters	88	75-109
Stock	107	98-110
Super Gas	106	100-110
Super Stock	112	100-117
Super Competition	108	101-116
Federal Mogul Dragster	126	128-132
Federal Mogul Funny Car	126	125-132
Competition	114	109-121
Top Fuel Funny car	134	130-136
Top Fuel Dragster	135	134-137
Pro-Stock	112	112-116

Sources: Gordon Bricken & Associates, *Measurement Results of Street Legal Drags Pomona International Raceway – City of Pomona*, February 17, 1999.
Gordon Bricken & Associates, *Results of the Trackside Measurements on February 3 and 4, 2000 – Pomona*, February 11, 2000.
Notes: Measurements were taken at 50 feet from the centerline of the nearest lane and 50 feet south of the starting line.

Street Legal. Street legal dragsters measured the lowest noise levels ranging from 75 dBA to 109 dBA Lmax at 50 feet from the centerline of the near lane. Typical noise levels attributable to street legal dragsters range from 85 dBA to 94 dBA Lmax at 50 feet from the centerline of the near lane. Street legal dragsters are anticipated to make up the majority of race events on the project site. These noise levels would attenuate at a rate of 6 dBA per doubling of distance. The starting line for the drag strip would be approximately 2,400 feet from the southern property line and the finish line would be approximately 1,900 feet from the southern property line. Typical noise levels attributable to street legal dragsters would range from 41 dBA to 77 dBA Lmax at the nearest Havasu RV Resort property line.

Applying the typical noise level range of 85 dBA to 94 dBA Lmax at 50 feet for street legal dragsters assuming that there are two cars per drag race, deriving a usage factor based on the amount of time Lmax noise levels would be generated in an hour of racing, drag races would be conducted in 3 hours consisting of 300 participants resulting in 50 races per hour for an estimated 1,200 seconds, hourly noise

levels attributed to street legal drag races would range between 56 dBA to 90 dBA Leq at 50 feet. The highest hourly noise level from the finish line to the southern property line would be 58 dBA Leq. Therefore, street class dragsters would not exceed the City's hourly noise ordinance of 85 dBA at the southern property line.

Summary. Based on the City's noise ordinance, the one to two professional class drag racing events per year would not exceed the hourly standard of 85 dBA Leq, but would have the potential to exceed the maximum noise level standard of 95 dBA Lmax for Noise Zone III uses at the southern property line, which would be audible at adjacent properties such as the Havasu RV Resort. Street legal drag racing events would comply with the City's noise ordinance with respect to hourly and maximum noise level standards for Noise Zone III uses. Noise attenuation measures would reduce drag strip noise for both professional and street legal drag racing events; however, professional drag race events would still exceed the City's noise ordinance with respect to maximum noise level standards at the project site's southern property line.

Pit Area Noise

The project would include a pit area for race participants during event days. Typically, the pit area is used by participants for parking RVs, trailers and setting up temporary work areas for mechanical activities on dragsters. Noise associated with pit areas generally include HVAC noise from RVs, pneumatic tools for conducting mechanical work and engine noise. Noise levels generated by HVAC equipment ranges from 60 dBA to 65 dBA Lmax at 50 feet from the source depending on the size of the HVAC equipment. Mechanical noise from pneumatic tools ranges from 70 dBA to 75 dBA Lmax at 50 feet from the work area. The pit area would be approximately 1,200 feet from the nearest Havasu RV Resort property line. Non-mitigated noise levels associated with the pit area would attenuate to approximately 40 dBA to 60 dBA Lmax at the southern property line. These noise levels are anticipated to be even lower at the Havasu RV Resort because they would be shielded within the pit area by RVs and trailers. Therefore, it is anticipated that pit area noise would comply with the City's noise ordinance.

Parking Lot Nose

The project would include a parking lot to accommodate spectator vehicles. It is assumed that out of an attendance volume of 5,000 spectators, approximately 3,300 vehicles would need to be parked on the project site. The sound exposure level (SEL) associated with a parking event is typically 71 dBA SEL at 50 feet. Parking lot activity would most likely occur over a period of a few hours as spectators arrive for an event. Conservatively assuming that all of the 3,300 parking stalls were to fill in one hour, parking lot noise would be approximately 71 dBA at 50 feet. As shown on Figure 2, the parking area is proposed in the southern portion of the site. Accounting for the acoustical center of the parking lot and a conservative distance to the southern property line (300 feet), the resulting noise level due to parking lot noise would be 55 dBA Leq. Therefore, it is anticipated that parking lot noise would comply with the City's noise ordinance.

Public Address System Noise

The proposed drag strip would incorporate the use of a PA system for announcements between races. In order for the PA to function properly and be clearly audible to spectators, the PA would have to emit a sound level approximately 10 to 15 dBA higher than the noise level of attending spectators and drag strip activities. It is not anticipated that PA announcements would be conducted during individual races so the system would not be required to emit a sound level 10 to 15 dBA higher than racing engine noise.

The use of directional speakers for the PA system would minimize noise levels at the Havasu RV Resort property line. Directional speakers limit the noise coverage pattern to an area intended for its use in conveying announcements to spectators. A combination of directional speakers may be required along the grand stands to clearly convey announcements which would entail design and installation considerations. Therefore, a qualified acoustical consultant would be required to design the PA speaker array and orientation to ensure that the project complies with the City's noise ordinance.

Recommended Operational Drag Strip Event Noise Attenuation Measures

N-1: Limit drag racing activities to the daytime hours only (7:00 a.m. to 10:00 p.m.) to avoid sleep disruption for Havasu RV Resort residents.

N-2: Construct solid backs on the grandstands on the west side of the drag strip to provide additional shielding. Construction materials of solid backs on the grandstands could be made of wood, concrete or noise absorbing material, but should be void of gaps where the grandstands meet the ground and extend to the top of the grandstands. This would provide approximately 5 to 8 dBA of reduction for starting line noise.

N-3: Construct a 10 foot wall/berm along the west side of the drag strip, beginning at the south end of the grandstands and extending past the finish line. This would provide approximately 5 to 8 dBA of reduction for finish line noise.

N-4: Notify adjacent Havasu RV Resort residents in writing within two weeks of any drag racing activity that would occur. The type and duration of the drag racing activity will be included in the notification.

N-5: Install directional speakers for the PA system to minimize amplified noise to the adjacent residents. Noise level analysis of the PA system prepared by an acoustical consultant will be submitted to City to demonstrate compliance with the noise ordinance.

3.5.2 Construction Noise

Development of the project would have the potential to result in short-term elevated noise levels in the surrounding area. Project-related construction activities with the potential to generate noise would include site grading and excavation, truck deliveries, and construction of new roadways. Earth moving would be conducted for up to a month using 2-5 scrapers to move approximately 500,000 cubic yards of cut and fill dirt. Track construction would entail one to two weeks of concrete pours. Typical noise levels for the types of construction equipment that would be used during site development range from 74 dBA to 89 dBA at 50 feet.

The extent of the elevated noise levels will depend on the type, duration, and location of the construction activity. To assess noise levels associated with the various types and operations, construction equipment can be considered to operate in two modes, mobile and stationary. Mobile equipment sources travel throughout a construction site conducting tasks in a recurring manner (scrapers). Stationary equipment operates in a fixed location for an extended period of time, and can be conducting continuous or variable operations (generators). Thus, determining the location of stationary sources during specific phases, or the effective acoustical center of operations for mobile equipment during various phases of the construction process is necessary. Operational characteristics of heavy

construction equipment are additionally typified by short periods of full power operation followed by extended periods of operation at lower power, idling, or powered off conditions. To more accurately account for variations in equipment power expenditures, adjustments based on duty cycle applied to reference noise levels in terms of a "usage factor." Conservatively, construction of track and ancillary facilities would generate combined heavy duty construction equipment noise levels of approximately 86 dBA Leq at 50 feet from the center of construction activity. Table 5 shows the combined heavy duty construction equipment noise levels associated with the construction of project improvements.

Table 5 Predicted Noise Levels Attributable to Major Construction Activities

Project Component	Distance to Havasu RV Resort from Center of Construction Activity (Feet)	Resulting Noise Level in dBA Leq
Roadway (relocation of Whelan Drive)	50	86
Parking lot	900	55
Pit Area	1,400	50
Track – Finish Line	2,000	46
Track – Starting Line	2,400	44

Notes: dBA = A-weighted decibel; L_{eq} = energy-equivalent noise level
Equation: L_{eq}(equipment) = E.L.+10*log (U.F.) - 20*log (D/50) - 10*G*log (D/50)
Source: FTA 2006; Data modeled by Atkins in 2012

As shown in Table 5, the relocation of Whelan Drive to the south has the potential to cause the greatest disturbance of the noise environment for surrounding uses such as the Havasu RV Resort. Predicted construction noise levels of 86 dBA Leq at 50 feet would be short term and temporary. Construction noise levels associated with other project improvements are not anticipated to generate excessive noise levels at the Havasu RV Resort. Construction operations conducted within 500 feet of a residential zone would be limited to the hours between 7:00 a.m. and 10:00 p.m., Monday through Friday, and when conducted during weekends and holidays would be limited to the hours between 7:00 a.m. and 7:00 p.m. Project construction activities are expected to comply with the City's noise ordinance construction start and stop times, and the following best managing practices would reduce the potential for short term and temporary construction noise level increases.

Construction Best Management Practices (BMPs)

Implementation of the following best management practices would reduce disturbance associated with construction noise.

N-6: Construction Equipment Noise Reduction Measures. Construction contractors for project improvements will implement the following BMPs to minimize short-term noise levels caused by construction activities. BMPs to reduce construction noise shall be included in contractor specifications and shall include, but not be limited to, the following:

i. Conduct construction activities within the daytime hours as stated in the City's noise ordinance Section 9.30.070.

ii. Properly outfit and maintain construction equipment with manufacturer-recommended noise-reduction devices to minimize construction-generated noise.
iii. Operate all diesel equipment with closed engine doors and equip with factory recommended mufflers.
iv. Use electrical power to operate air compressors and similar power tools.
v. Notify adjacent residents in writing within two weeks of any construction activity of large-scale grading operations that would occur within 100 feet of the property line of the Havasu RV Resort. The extent and duration of the construction activity will be included in the notification.

3.5.3 Groundborne Vibration

The main concerns related to groundborne vibration are annoyance and damage. As described above, the vibration velocity level threshold of perception for humans is approximately 65 VdB, and 75 VdB is the approximate dividing line between barely perceptible and distinctly perceptible levels. High groundborne vibration at each of the project improvement construction areas would attenuate rapidly and only affect receptors within close proximity to the individual pieces of construction equipment. Construction associated with relocating Whelan Drive to the south would be in close proximity to the Havasu RV Resort and would be the only project improvement that would have the potential for annoyance.

Typical equipment that would be used during construction of the proposed Whelan Drive alignment would include, but not be limited to, excavators, off-highway tractors and trucks, material handling equipment, pavers, pumpers, rollers, bulldozers, surfacing and grading equipment, backhoes, and trenchers. Project related roadway construction activities would have the potential to generate low levels of ground-borne vibration; however, it would be short term and temporary and conducted during daytime hours. Roadway construction could cause short term vibration that may be felt at surrounding properties such as the Havasu RV Resort that may be annoying, but damage to structures is not anticipated. There are no specific vibration limits established by the City and construction activities would be limited to daytime hours as part of the projects BMPs. Short-term vibration effects would cease upon completion of project construction.

3.5.4 Transportation Noise

Roadway Noise

Traffic noise modeling was conducted based on average daily traffic volumes obtained from Google Earth Traffic Count Data. The FHWA Highway Traffic Noise Prediction Model (FHWA RD 77-108) was used to calculate traffic noise levels along affected roadways, based on the trip distribution estimates that were derived from the anticipated number of racers (300) and spectators (5,000) attending an event. It was assumed that approximately 3,300 vehicles would transport the potential 5,000 spectators attending an event at the track. These vehicle trips were considered to be automobiles, while the 300 racers were assumed to use heavy trucks to transport racers and their race equipment to the track. Adjustments were made to the vehicle mix inputs in the model to account for the higher noise levels associated with the increase of project related heavy trucks. Roadway segments along SR-95 were modeled assuming all project traffic would be travelling on each segment. This provides for the most conservative assessment for project related traffic noise level increases.

The project's contribution to the existing traffic noise levels along area roadways was determined by comparing the predicted noise levels at a reference distance of 100 feet from the roadway centerline for the existing and existing plus project conditions to account for project-generated traffic. Traffic noise modeling does not account for local topographic shielding including any walls, berms, buildings, or other existing barriers. Table 6 shows the results of project related traffic noise level increases along SR 95 and project related traffic noise along Whelan Drive. The change in noise levels shown in Table 6 would only occur during times when racing events are scheduled at the project site. These changes in traffic noise levels would only be temporary and short term during event days. The traffic noise analysis presented in Table 6 is the most conservative approach to analyzing the project's contribution to existing traffic noise on affected roadways.

Table 6 Modeled Project Generated Traffic Noise Levels

Roadway	Segment		L_{dn} (dBA) at 100 feet		
	From	To	Existing	Existing Plus Project	Change
SR-95	Whelan Drive	to the north	63	66	3
	Whelan Drive	Jacob Row	66	67	2
	Jacob Row	Kiowa Boulevard	68	69	1
	Kiowa Boulevard	Industrial Boulevard	68	69	1
Whelan Drive	SR-95	Project Site	--	63[1]	--

Notes: Whelan Drive traffic noise levels were predicted at a distance of 50 feet to account for its proximity to Havasu RV Resort receptors.
Source: FHWA Highway Noise Prediction Model. See Appendix B for model output.

As shown in Table 6, modeled project related traffic noise level increases would range from +1 dBA to +3 dBA Ldn along SR-95 segments. It should be noted that a traffic distribution was not applied; rather all project related traffic was modeled for each segment and did not account for various route patterns that may be taken by individual spectators and racers. Modeling all project related traffic on each segment represents the most conservative approach to predicting traffic noise level increases due to the project. Project related traffic noise level increases are not expected to result in a substantial increase relative to existing conditions.

4.0 Conclusion

Operation of the proposed project would result in excessive maximum noise levels related to professional dragster racing events that are expected to occur up to twice per year. Attenuation measures included in this report would reduce excessive maximum noise levels of professional dragsters, but maximum noise levels would remain excessive and substantial. Operation of the proposed project would not result in excessive noise levels related to street legal dragster racing events that would occur during the spring and fall seasons. Implementation of attenuation measures such as solid back grandstands and incorporating a berm/wall to shield finish line noise that would reduce excessive professional dragster maximum noise levels, but maximum noise levels would not comply with the City's noise ordinance. The noise increases associated with racing events would occur during the spring and

fall seasons. During the winter and summer months, day to day operational noise levels would not substantially increase over existing conditions.

Other operational components of the project (pit area noise, parking lot noise, and PA system noise) are anticipated to comply with allowable noise levels contained in the City's noise ordinance. Construction of the proposed project would result in short-term noise increases that may affect surrounding uses; however, compliance with the daytime operating limits included in the City noise ordinance and implementation of best management practices would reduce excessive construction noise levels to the extent feasible. The proposed project would result in traffic noise increases along SR 95 and the relocation of Whelan Drive within the project site; however, these short-term increases in traffic noise would only occur during days when events are scheduled and would not be considered substantial. There would be no substantial adverse long-term traffic noise increases associated with implementation of the project.

5.0 References

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